THURSDAY, MARCH 8, 1883

THE ORIGIN OF CULTIVATED PLANTS

Origine des Plantes cultivées. Par Alph. de Candolle (Paris: Germer, Baillière et Cie., 1883.)

Les Plantes potagères, Description et Culture des principaux Légumes des Climats tempérés. Par Vilmorin-Andrieux et Cie. (Paris: Vilmorin-Andrieux et Cie., 1883.)

ALPHONSE DE CANDOLLE occupies a position in the botanical world which in its way is unique. He is in a manner the *doyen* amongst the heads of the botanical establishments of different countries which have for their especial object the study of the earth's vegetation in its taxonomic aspect. There is a special appropriateness in his being so; the Geneva botanical school, though in filiation related to the French, has always seemed to belong more to Europe than to Switzerland. The effect of this circumstance has doubtless operated indirectly on a mind naturally inclined to wide and general views. Accordingly as the invaluable "Prodromus"—the only modern work which has attempted to describe all known species of flowering plants—drew near the point at which it was decided to conclude it after occupying two generations of botanists, we find De Candolle himself more and more engaged with works dealing with general questions—works which both temperament and point of view peculiarly fitted him to undertake. Such were his "Histoire des Sciences et des Savants depuis deux Siècles," published in 1873, and his "Phytographie; ou, L'Art de décrire les Végétaux,'' published more recently (1880).

Long ago however, in 1855, he had published his classical "Géographie botanique raisonnée,'' and in this he had stated the theory, sufficiently novel then, though now a commonplace, that the present distribution of the earth's flora cannot be accounted for by any possibility as the result of the existing configuration of its surface, but is the gradual result of long antecedent geological changes. De Candolle's conclusions are now seen to form a particular case in the general theory of evolution. But we must not forget that they were the independent result of a long and laborious induction.

The study of geographical distribution requires the elimination from the facts of all disturbing elements. It is necessary to ascertain the precise nature of the flora of any given district undisturbed by artificial modifications. The slow action of natural forces is one thing: the changes brought about by man are another. De Candolle was therefore obliged to devote no small attention to the question of introduced and cultivated plants. They must clearly be eliminated from the enumeration of feral productions. But the question then arises, What is to be done with them, and to the flora of what country are they to be relegated? The result is not merely one of disembarrassment to the botanist; it has its interest no less for anthropology in the widest sense. Different races have taken advantage of plants susceptible of cultivation in the places where nature had originally planted them; and as these races have migrated they have taken their cultures with them. If the botanist then does his work properly in tracking them back to their original cradle, he is tracking back the migratory race as well, and doing the work of the anthropologist. Plants often take their old names with them, and these may and frequently have persisted when the race that brought them has passed away, been dispersed, or changed its language. All the various names, for example, given to hemp by the descendants of the Aryan race go back to the same root.

These considerations will be sufficient to establish the utility of the study which De Candolle has had in hand for some thirty years, and with regard to which he has now given us, in a singularly succinct form, probably as much as we are ever likely to know. Hitherto we have been badly off for a handy synopsis of the subject. It is true we have the chapter in De Candolle's work already referred to, and Mr. Darwin brought together a considerable body of information in his "Variation of Animals and Plants under Domestication." The former book has, however, long been out of print, and Mr. Darwin's purpose only led him to deal with those species which have largely varied under cultivation. For my own part I have generally used for reference the two admirable articles in the ninth volume of the *Journal* of the Horticultural Society—a body which unhappily, while taking the title of Royal seems to have lost its taste for such studies. These articles—in form a review of a little work by Targioni-Tozzetti, of which I have never seen but a single copy—are really an extremely useful examination of the whole subject; and as it is an open secret that they are from the pen of Mr. Bentham, the critical opinions they contain as to the origin of all our more important cultivated plants may be relied upon with considerable confidence.

"An English vegetable garden,'' says Mr. Tylor, "is a curious study for the botanist, who assigns to each plant its proper home; and to the philologist, who traces its name.'' But De Candolle, not confining himself to our temperate pot-herbs, has included in his studies the cultivated plants of all countries. Accurate knowledge in this matter is a thing of comparatively recent growth. Linnæus bestowed no pains upon it. Humboldt in 1807 dismissed it as an impenetrable secret. De Candolle has now discussed no less than 247 species. It is curious—perhaps significant—to note that 199 of these trace back to the Old World; only 45 are American, and 3 doubtful. Neither the tropical nor the southern regions of either hemisphere have any of these species in common. The northern have five which are so, but it goes with the rest of the facts that the domestication of these belongs to the Old World, and to this De Candolle has accordingly credited them. Some things no doubt have escaped him, although the list is remarkably complete. Perhaps the most curious omission is rhubarb, the use of which for the table seems pretty much confined to England and Holland.

It is rather to be regretted that De Candolle has abandoned the attempt to indicate the points on the earth's surface from which the maximum number of cultivated plants appear to have sprung. He contents himself with saying that the original distribution of the stocks of cultivated plants is most irregular. "It had no relation with the needs of man supplied nor with the area of origin." I have a decided suspicion that the facts might be made to yield a different result. There does not seem any *a priori* reason why plants susceptible of useful development under cultivation should be so arbitrarily distributed. The number of species domesticated in a given area would, other things being equal, seem to be related to the intelligence of the races working on them. North America has only given us the vegetable marrow and the Jerusalem artichoke; and neither deserve more than a *succès d'estime*. But our best domesticated plants have developed their merits *pari passu* with the races that educated them. If we stumbled *now* against the primitive stocks they might seem as little susceptible of development as the plants of the United States, whose capabilities we rank so low. But had the Old World races been but early enough on the New World soil to work out their progress to civilisation, possibly the balance in the proportion of domesticated plants would have been redressed. If the gardens of the United States are filled with Old World vegetables, the houses are inhabited by an Old World stock. The two things seem to me to go together; the indigenous races could neither develop their latent vegetables nor hold their own against an Old World human invasion.

The circumstances of domestication, however, impose certain conditions which the flora drawn upon must fulfil The early stages of civilisation were probably unsuited to any fixity of abode. Tylor, it is true, remarks that "even very rude people mostly plant a little." But they will plant only what will give a quick return, and the qualities of foresight as well as a permanent social structure must be developed before men would have the disposition to plant fruit trees, which perhaps only their descendants would gather from. The first domesticated plants must have been those that were in themselves succulent, or would in the course of a single season yield some desired product. We find then that out of the 44 species, the cultivation of which in the Old World goes back to the dawn of civilisation, half are annuals; and these are just what the great temperate flora of the northern hemisphere would supply. On the other hand, Patagonia and South Africa have not yielded a single domesticated plant. Australia only contributes the overrated *Eucalyptus globulus*, and New Zealand a wretched spinach (*Tetragonia*). But then, as De Candolle remarks, their floras are destitute of the types of *Gramineæ*, *Leguminosæ*, and *Cruciferæ*, which were available in the northern hemisphere, and predominate in the list of the 44 most anciently cultivated plants. As between the north and the south I think this argument is valid. But as between the east and the west in the north hemisphere, since the main features of the flora are radically the same, any similar explanation does not hold.

With regard to such of these primitive cultures as belong to the temperate regions of the Old World, it will be interesting to give De Candolle's conclusions. The turnip and rapeseed (not however sustainable as distinct species) originated in Northern Europe. The cabbage was derived from the western coasts of Europe, where its wild stock may still be found; it was first gathered and then cultivated by pre-Aryan races. Purslane is wild from the Western Himalayas to Greece. The onion was brought from Western Asia. As to textiles, the origin of flax is somewhat complicated. The inhabitants of the Swiss lake-dwellings of the Stone Age did not use our present annual flax but a subperennial sort indigenous to Southern Europe (*Linum angustifolium*). This was displaced by *Linum usitatissimum*, a native of countries south of the Caspian, which was introduced into Europe and India by Aryan races. The knowledge of hemp seems to have been brought into Europe by the Scythians about 1500 B.C.; there is no trace of it in the Swiss lake-dwellings. The vine is indigenous in Western Asia, whence its use was carried to various countries by both Aryan and Semitic races; but it did not reach China before 122 B.C.

The almond, although so characteristic of Mediterranean countries, seems to be a native of Western Asia, and perhaps Greece. As late as the time of Pliny the fruits were known to the Romans as *Nuces græcæ*. The wild stocks of our pears and apples seem to have been indigenous to Southern Europe and Western Asia before the Aryan invasion; their remains abound in the Swiss lake-dwellings. The quince is a native of North Persia, but seems to have been introduced into Eastern Europe in pre-Hellenic times. Remains of a form of the pomegranate have been found in strata of the Pleiocene age in Southern France by Saporta; but it died out and was reintroduced from countries adjoining Persia in prehistoric times into the Mediterranean region of which it is now so characteristic a feature. The primitive home of the olive was apparently the eastern shores of the Mediterranean, where the Greeks discovered its useful qualities the Romans learning them later. The fig has left its remains in quaternary rocks in France along with the teeth of *Elephas primigenius*, but its prehistoric home must be sought in the Southern Mediterranean shores and lands, where it survived after probably perishing in France. The common bean (*Faba vulgaris*) seems to have become extinct in a wild state; it may have originated south of the Caspian, and was introduced into Europe by the Aryans. The remains of lentils have been found in lake-dwellings of the Bronze Age, and it was probably indigenous in Western Asia, Greece, and Italy before its cultivation in these countries; subsequently it was introduced into Egypt. The chick-pea was carried from the south of the Caucasus by the Aryans to India and Europe. The carob is indigenous to the Eastern Mediterranean, whence the Greeks introduced it into Italy and the Arabs into Western Europe. De Candolle regards all the various kinds of wheat as derivatives of the small-grained kind found in the most ancient lake-dwellings of Western Switzerland. He inclines to the belief that the wild stock of this originated in Mesopotamia, where it may still exist. The origin of spelt is very doubtful, and it may possibly be an ancient cultivated derivative from the wheat stock. As to barley, the inhabitants of the Swiss lake-dwellings cultivated both the two-rowed and the six-rowed kinds. The former is found spontaneously in the area between the Red Sea and the Caspian; but nothing is known of the spontaneous occurrence of the latter or of the four-rowed kind. Either then both were derivatives in prehistoric times of the two-rowed variety, or they are the cultivated representatives of species which have since become extinct. As to rye, probability points to an origin in South-Eastern Europe. The lake-dwellers even of the age of Bronze did not know it, but Pliny mentions its cultivation near Turin. De Candolle supposes that the Aryan migrations westward met with it in Europe and carried it onward. Oats seem also to have originated in Eastern Europe; they are found not earlier than the Bronze Age in Switzerland. From Pliny's mention that the Germans used oatmeal, it is concluded that it was not cultivated by the Romans.

Space will not allow of my giving an idea of the method by which these results are arrived at. But they seem to me to take advantage of every line of evidence and to be as near the truth as we are at present likely to approach. De Candolle sums up with great pains the philological evidence which he has collected from the best quarters, and though, as he is prepared to admit, a professed philologist might handle the evidence in a different way, he claims that the inferences he draws are such as are fairly within the competence of instructed common sense. And controlled as they are by other lines of inquiry they do not seem to me to be pushed to a point where, except in the hands of an expert, they would be likely to prove treacherous. It is obvious that the philological evidence alone might make the most careful go astray. The two instances given by Tylor are, in a way, a case in point. "Sometimes," he remarks, "this (the name) tells its story fairly, as where damson and peach describe these fruits as brought from Damascus and Persia." This is true perhaps as far as it goes. The cultivated plums of Damascus had a reputation in the time of Pliny; but the wild stock does not extend to the Lebanon, and its home was probably far to the north in Anatolia and Northern Persia. As to the peach, De Candolle points out that its having no Sanscrit or Hebrew name is against an origin in Western Asia, and he gives a considerable body of evidence pointing to China as its true native country.

It is in fact the indirect evidence given by such names through their origin and history which is of use, not the actual information they imply. The Jerusalem artichoke is a well-known instance. As De Candolle says, it is not an artichoke, and being a North American plant can have nothing to do with the Holy Land. The plant is technically a sun-flower (*Helianthus*), though in our climate it rarely betrays its affinity by flowering. And the ordinary explanation is that Jerusalem is a corruption of *Girasole*. But this seems to be a wanton piece of euhemerism; there is no evidence that the Italians ever used such a name for it, and the real explanation seems to be that Jerusalem was applied in a vague way, like Indian or Welsh, simply to indicate a foreign origin. Thus an old-fashioned garden plant (*Phlomis fruticosa*) is called sage of Jerusalem with about as little reason. And in France the term Jerusalem artichoke is applied to a species of gourd.

The second work which I have cited at the head of this article deserves a more extended notice than it is possible to give it. It is safe to say that only in France could such a book be produced, either as regards the share of authors or publishers. It is a sort of complement to De Candolle's treatise, describing, from the cultural point of view (but with botanical references apparently carefully accurate), the various esculent vegetables which are known, with all their typical varieties, including even such sorts as are rarely seen in the gardens of cool countries. It is a book which any botanist will find a useful addition to his library, if only for the delicate illustrations, which contrast so strikingly with the coarse ostentation of the ordinary trade catalogue.

W. T. T. D.

OUR BOOK SHELF

Useful Rules and Tables relating to Mensuration, Engineering, Structures, and Materials. By William John Macquorn Rankine, C.E., F.R.S., &c. Sixth Edition, thoroughly Revised by W. J. Millar, C.E. With Appendix, Tables, Tests, and Formulæ for the use of Electrical Engineers, by Andrew Jamieson, C.E., F.R.S.E. (London: Charles Griffin and Co., 1883.)

WE learn from the title-page of this edition of Rankine's well-known book of Rules and Tables that it has been thoroughly revised, but we are sorry to find so little evidence of this in the work itself. Many of the rules given in this book are only applicable in particular cases, and generally no explanation as to this is given. Take for example Rule XXV., p. 211, which gives the collapsing pressure of tubes as $\frac{9672000 \times \text{thickness}^2}{\text{length} \times \text{diameter}}$. This rule is evidently based on Fairbairn's experiments, which were made on tubes with closed ends and of lengths in no case exceeding ten times the diameter. The rule as it stands is simply absurd, for it gives zero collapsing pressure for infinite length. The addendum to Part II. p. 367, referring to springs, may be taken as another example. Straight springs cannot be treated by the formulæ given for beams unless they are only slightly bent, and again, the ratio of the force to the elongation produced by it in a spiral spring is that given by the formula only when the spires have small inclination to a plane at right angles to the axis. This formula is not even accurate, as the r^3 in the denominator should be r^2. Some estimate of the care bestowed on the work by the editor may be gathered from the following slovenly sentences taken from p. 374:—"From experiments by Major Morant, R.E., India, it appears that only one-half the quantity of dynamite and one-third the number of bore-holes is required to remove the same quantity of rock as gunpowder." "The area of the fire-grate being about 14½ square feet."

The Appendix on Tables, Tests, and Formulæ, for the use of electrical engineers, is a real addition to the book. Beginning with a table of the "Formulæ of the Absolute Units," Mr. Jamieson goes on to the definition of the different practical units now in use; and then gives a large amount of useful information in the form of tables and rules for making electrical tests. Much of the information here given is published for the first time, and on this account will be the more valuable to engineers.

Cable work has received special attention, and although not fully treated, absorbs, we think, more than its due share of the sixty-four pages devoted to the appendix. The space taken up by some of the less useful tables might, it seems to us, have been saved, and a fuller treatment of the different methods of testing electromotive force, battery- and other resistances, &c., given. Mr. Jamieson gives only a few rules for such tests, and refers to other books for more, but we think that a book of rules should be full if it be anything. In order to measure the resistance of thick wire, Mr. Jamieson suggests that a piece of it may be drawn down to a fine gauge, and then tested in the Wheatstone bridge. This is neither convenient nor satisfactory, and should be replaced by one of the well-known methods of testing such wires. Again on page 361, Mr. Jamieson proposes to measure the work done in charging a secondary battery by joining up a suitable voltameter as a shunt to it. This method is worse than useless.

Although we should like to see an absence of such faults as the above, and considerably more space devoted